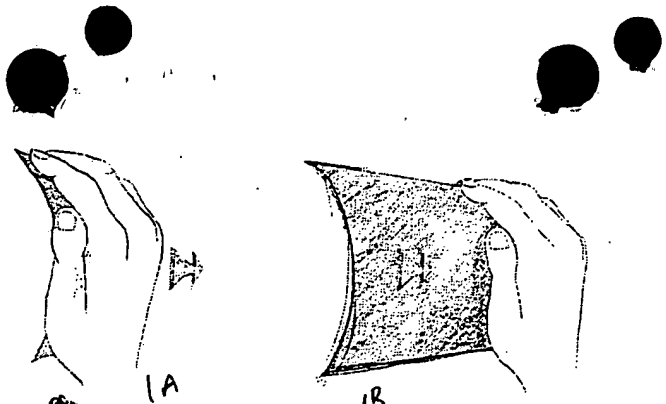


Figure 1: *A simple drawing motion produces a small surface patch.*

Figure 2: *Perceptual interaction with a surface in the semi-immersive environment of the Responsive Workbench.*

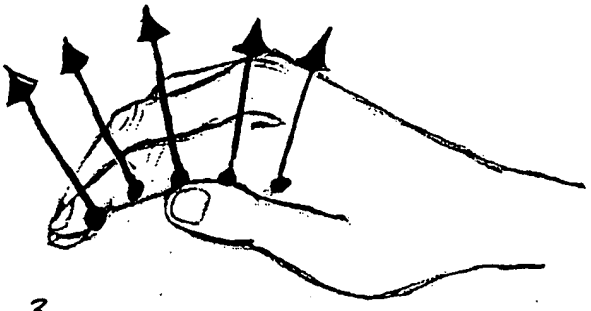
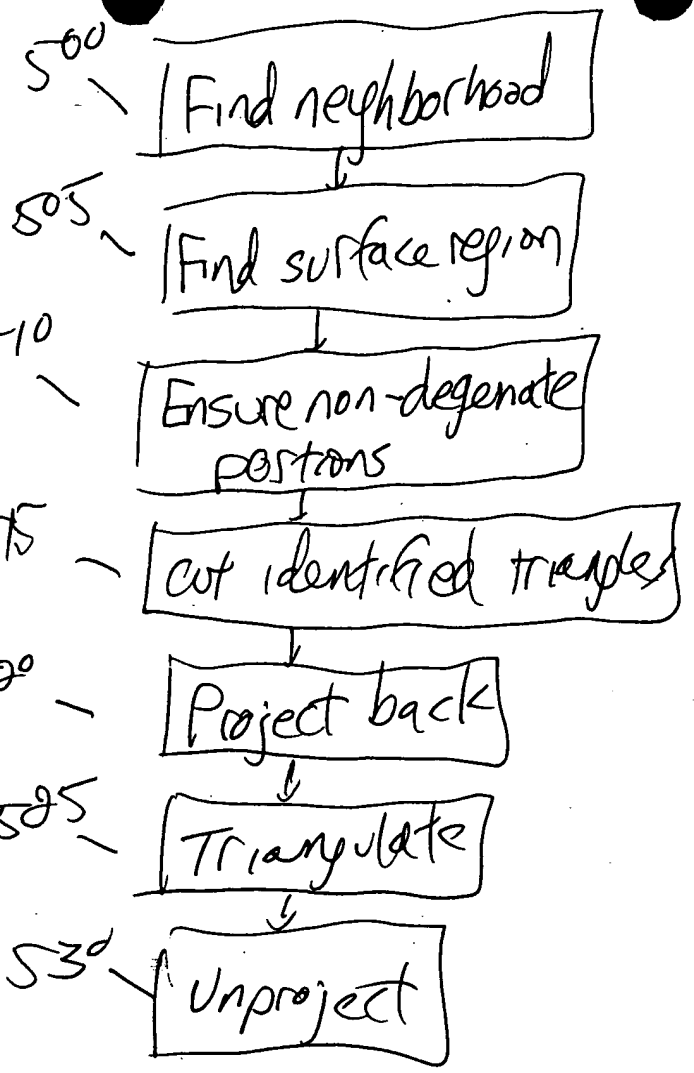


Figure 3: *In the primary drawing mode, we sample position and orientation at five locations along the index finger and palm.*



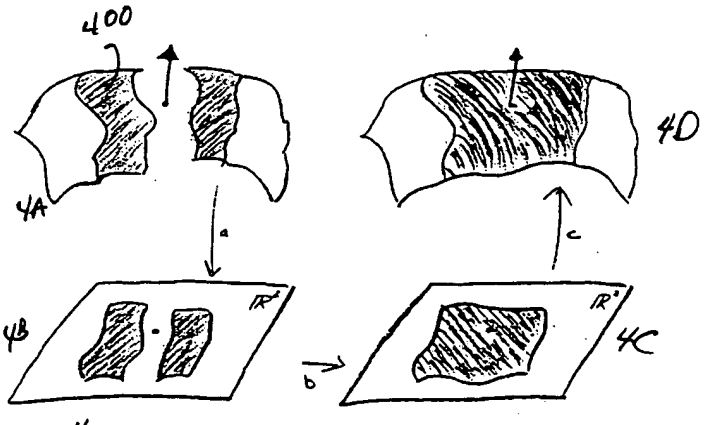


Figure 4: *An overview of the Cookie Cutter algorithm. A surface patch (shaded) near the new sample is identified. Then it is (a) projected onto* $\mathbf{R}^2$*, (b) retriangulated, and (c) moved back to the original mesh.*

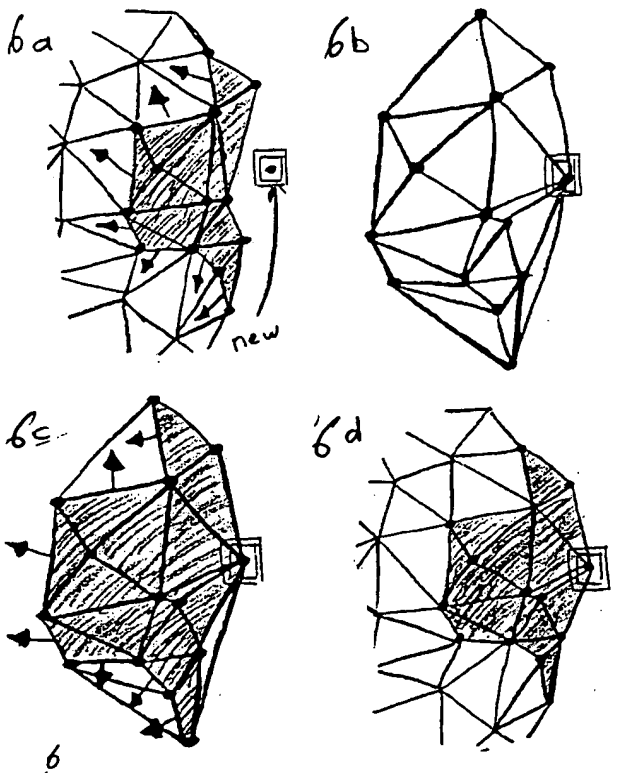


Figure 6: *A portion of the mesh is cut out and replaced by a mesh region that contains the new sample. (a) After the addition of a new sample, the samples in the neighborhood (heavy dots) and boundary edges (with arrows) are identified. The triangles in the neighborhood $N_t(x)$ (shaded) are removed. (b) The sample neighborhood is retriangulated. (c) Triangles (shaded) that are neither on the wrong side of a boundary edge, nor have large circumcircle, are identified. (d) The identified triangles are added to the mesh.*

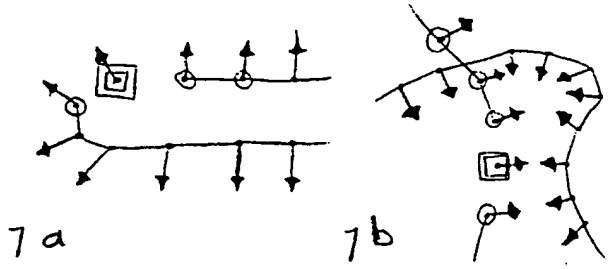


Figure 7: *A neighborhood (circled points) is taken around a new sample (in square). Using a simple dot product test, neighborhoods on (a) surfaces with high curvature and (b) intersecting or almost-touching surfaces can be formed correctly.*

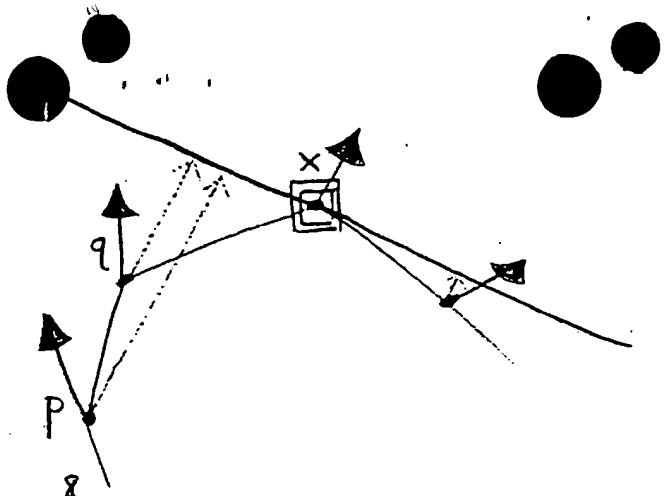


Figure 8: *In this cross-section of a mesh, the triangle containing p and q is flipped when it is projected onto the tangent plane of the new sample x*

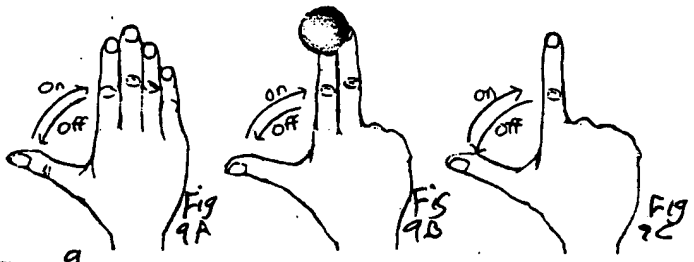


Figure 9: *Three hand positions are identified: (a) the user draws with the index finger and palm; (b) an eraser is placed at the end of the index and middle fingers; (c) fine details are added with the tip of the finger. In all three situations, the thumb is used to activate and deactivate the operation.*

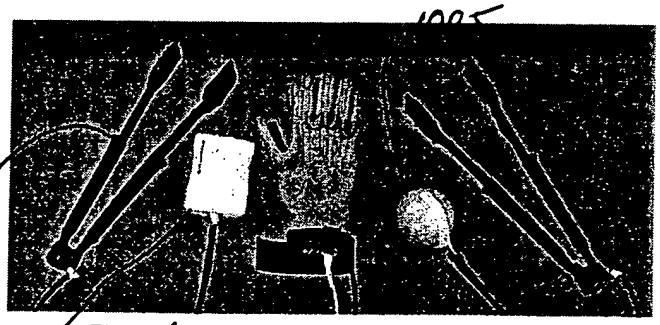


Figure 10: *Physical props are used for interaction.*

FIG 10

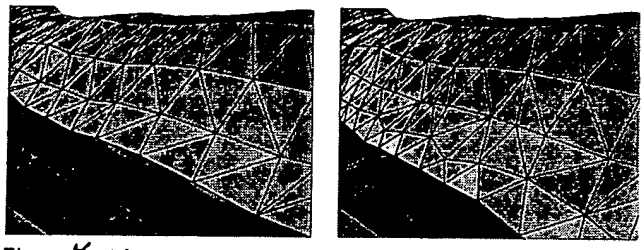


Figure 4: *After a stroke is placed (left), portions of its boundary which are near enough to the extant drawing are joined to the drawing (right) by associating the boundary of the stroke with a path on the drawing.*

FIG 11

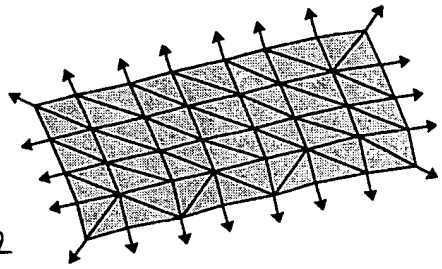


FIG 12

Figure 6: *A triangulated stroke is shown with associated boundary vectors.*

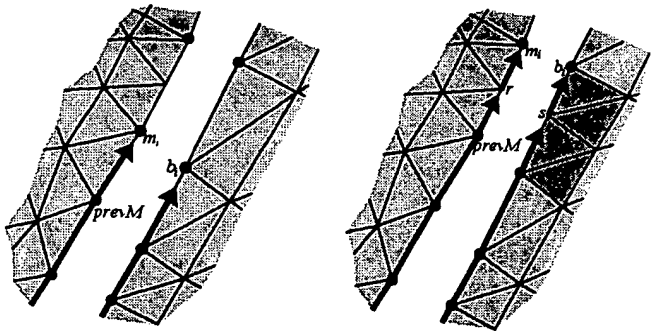


Figure 7: *Two steps of the algorithm* `BuildPaths`*, which constructs matching paths* $mPath$ *and* $bPath$ *on the drawing and the stroke boundary. (a) The paths are grown by adding samples* m_i*. (b) The paths are grown by adding an intermediate sample to each before adding* m_i *and* b_i*. The stroke is subdivided to generate its intermediate sample.*

FIG 14

FIG 13A FIG 13B FIG 13C

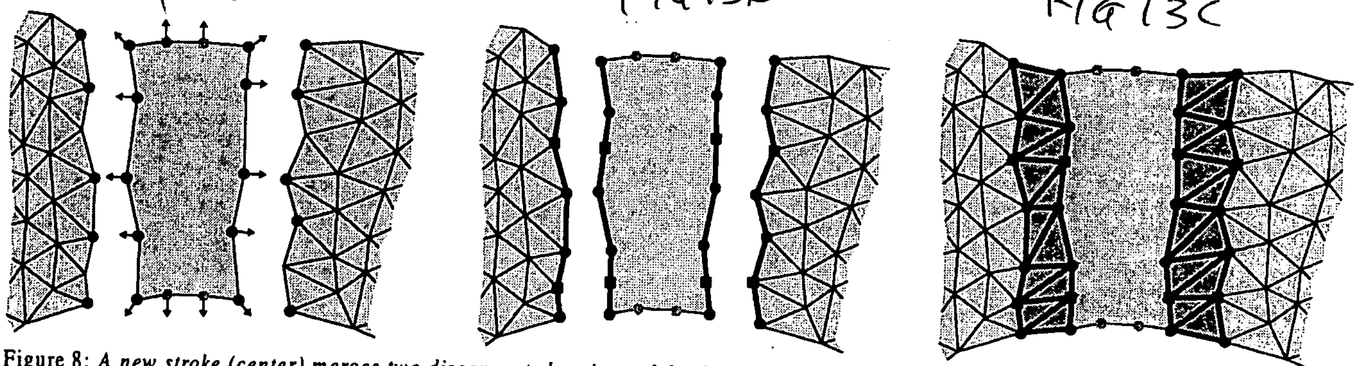


Figure 8: *A new stroke (center) merges two disconnected regions of the drawing. (a) Using boundary vectors (arrows), the boundary points are matched with corresponding samples. Matched samples are represented as circles. Empty circles represent samples on the drawing with no matches. (b) The matching samples are connected to form path pairs. Note that forming these paths requires the inclusion of extra samples (shown as squares) on the drawing. The stroke boundary is subdivided to accommodate these samples. (c) Triangles are formed between path pairs. These new triangles, along with the triangles in the stroke, are added to the drawing.*

FIG 13

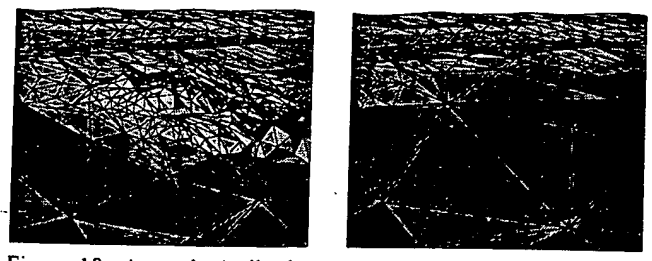


Figure 10: *A topologically degenerate mesh region (left) is converted into a manifold.* FIG 15

FIG 16A

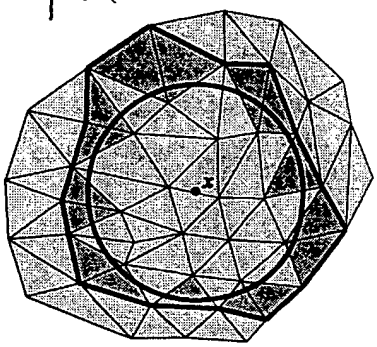


FIG 16B

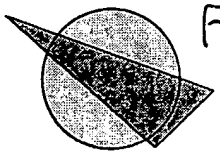


FIG 16C

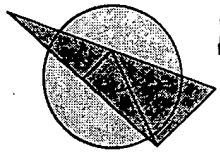


Figure 11: *The image on the left shows a set of border edges (bold lines) that are discovered around the neighborhood $B_n(x)$. As depicted on the right, edge splits are applied to triangles which are relatively large.*

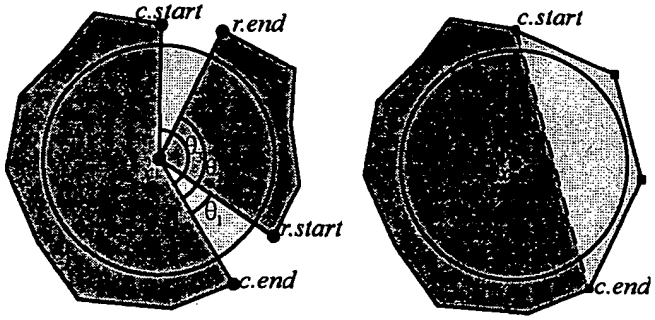


Figure 12: *On the left, an open ring is only concatenated when $\theta_1 < \theta_2$ and $\theta_2 < \theta_3$. On the right, instead of adding an edge with a prohibitively large angle (dashed line) that would lie inside the circle, the square vertices are added.*

FIG 17

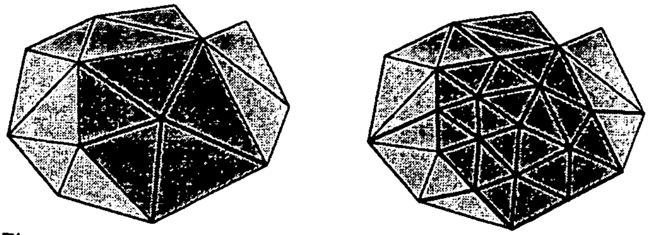


Figure ~~14~~: *The blue triangles in the left image represent a simple tessellation of a ring. If the original neighborhood has a large number of samples in it, this tessellation is subdivided and perturbed to approximate the initial geometry.*

FIG 18

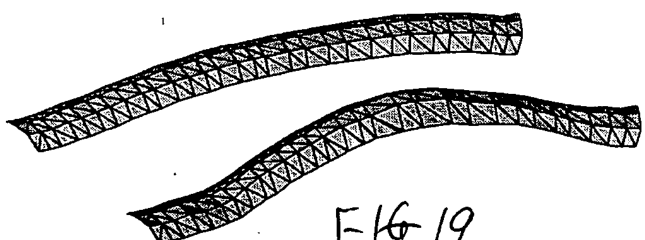


FIG 19